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THE NEW ENGLAND BOTANICAL CLUB

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VARIATION IN POLEMONIUM REPTANS

E. Lucy Braun[1]

Polemonium reptans L. varies as to height and habit of branching, number and shape of leaflets, size of corolla, shape of sepals, and density, length, and nature of pubescence. Two taxa within the complex should be distinguished—var. *reptans* and var. *villosum*—which in this paper will be referred to as *reptans* and *villosum*. The former is more variable than the latter. The writer believes that the variability of *reptans* is due to introgression, that the introgressant is the more stable *villosum;* variation within *villosum* may be coming from introgression from *reptans*.

In 1940, *villosum* was described as a variety of *P. reptans* (Braun, 1940). In 1942, Wherry reduced this to forma *villosum*, claiming that plants of this character "may appear almost everywhere over the range" (Wherry, 1942). In 1950, Davidson, in his monograph on the genus *Polemonium*, reduced *villosum* to synonymy with *P. reptans*, because he grew plants from seed of "glabrous and pubescent forms" furnished by Wherry (presumably from Pennsylvania), and found that "the plants grown from the two lots of seed were all quite glabrous, and the advisability of according taxonomic recognition to such an evanescent character is considered doubtful, even in the category of 'forma'" (Davidson, 1950).

Unfortunately, Davidson obtained no seed of the glandular-villous *villosum* from the geographic area whence it had been

[1] The writer expresses thanks to Dr. Edgar Anderson for his encouragement and helpful suggestions during the progress of this study, and to Dr. Richard P. Goldthwait for glacial boundaries on the map.

reported. Examination of all material in the Gray Herbarium previous to setting up this "variety" revealed no specimens comparable to it. Subsequent examination of specimens in the herbarium of the Missouri Botanical Garden, the Ohio State University, the University of Pennsylvania, and the herbarium of E. T. Wherry has further demonstrated that typical *villosum* is represented only by specimens from a limited geographic area —Adams, Highland, Pike, and Scioto counties, Ohio, and Lewis County, Kentucky. Ten of the 70 specimens in the Ohio State Herbarium are *villosum*, all from Adams and Scioto counties.

That *villosum* comes true from seed is amply demonstrated by the large pure populations occurring in its restricted range—populations of hundreds of plants. It comes true from seed in the writer's woodland. All colonies occur near the western border of the Unglaciated Allegheny Plateau (Fig. 1), an area which has had a long and complicated physiographic and climatic history, an area known for the occurrence of disjuncts, and of species at margin of their range (Braun, 1928, 1951; Thomas, 1951; Wolfe, 1951). Before discussing the possible history of *villosum* and *reptans*, the characters of the two taxa will be contrasted; consideration of intermediate or intergrading forms will follow. Mass collecting or population sampling methods have been used.

The "Manual" descriptions of *Polemonium reptans* (and Davidson's also) doubtless include the intermediate forms, which here are ommitted from the discussion of *reptans;* they do not include *villosum*.

The most constant diagnostic character of *villosum* is the densely glandular-villous inflorescence, in contrast to the "minutely puberulent" (Gleason, 1952) inflorescence of *reptans* (Fig. 2). The glandular hairs are multicellular, 0.5 to 1.0 mm. or more in length, and taper from base to glandular summit (Fig. 2E). In life, these glandular hairs may be seen without the aid of a lens, because of the conspicuous glistening glandular secretion present.

Stems and leaves of *villosum* are glandular-villous, but less densely so than the pedicels, except near the nodes. Glandular stem-hairs are often 1–2 mm. in length (Fig. 2C). The stems are not lustrous as are those of *reptans*. Hairs of the leaf rachis

FIG. 1. Map of southwestern Ohio and adjacent Kentucky showing location of populations of *Polemonium reptans* L. studied; the larger circles indicate populations used in graphs. The higher and more rugged Allegheny Plateau is to the east. Its western escarpment indicated by stronger hachures. The limit of Illinoian glaciation is shown by heavy full line (extending from upper right to Ohio River) and broken line (where less definitely known); limit of Wisconsin glaciation by dotted line. Glacial boundaries furnished by R. P. Goldthwait and (broken line) by J. Forsyth.

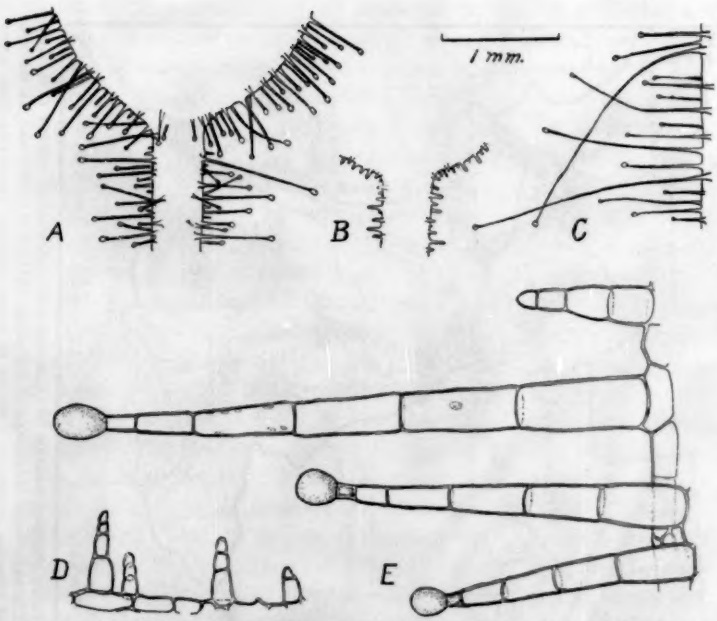

Fig. 2. Calyx, pedicel, and stem pubescence of *P. reptans* var. *reptans* and *P. reptans* var. *villosum:* A. Pedicel and lower part of calyx of *villosum;* B. Pedicel and lower part of calyx of *reptans;* C. Stem of *villosum*, just above lowest cauline leaf (A, B, and C in optical section; 1 mm. line shows scale); D. Greatly magnified pedicel hairs of *reptans* and E, of *villosum*. All drawn from living material.

are similar. Plants of *villosum* are so viscid that bits of humus and other foreign matter, and small insects are seen adhering to stems and pedicels. These help to give herbarium specimens of *villosum* their characteristic aspect. An odor of skunk, similar to that of certain western species of *Polemonium*, is noticeable if living plants have been enclosed, as when collecting in plastic bags, and, at times, when handled in the open.

In general, plants of *villosum* are lower than those of *reptans*, and the main stems diverge from one another at a wider angle.

Basal leaves of *villosum* tend to have fewer leaflets than those of *reptans*. The ratio of length to width of leaflets differs in the two. Leaflets of *reptans* are more than twice as long as wide; those of *villosum* mostly less than twice as long as wide (Figs. 3, 4). Differences in leaves in the inflorescence may be

less pronounced. Correlated with the broader and shorter leaflets of *villosum*, apical and basal angles are normally wider than those of *reptans* (Figs. 3, 4). Leaflets often are not "acute" as are those of *reptans*, the margins sometimes converging at angle of 105° or more, and often over 90° seldom less than 75°. Although the ranges of leaflet number and of length : width ratio overlap, populations of the two taxa are noticeably different in leaf aspect.

Flowers of *villosum* are smaller than those of *reptans*, 8–12 or rarely 13 mm. long, in contrast to 12–16 mm. long. The size differences of wide-open flowers (measured in the field) is more prominent: 11–17 mm. (av. 14 mm.) in diameter, as contrasted with 18–23 mm. (av. 19.5 mm.).

Many pedicels of *villosum* are shorter than the calyx, both in flower and fruit. The calyx lobes are shorter and broader, not "lanceolate to lance-triangular" (Fernald, 1950) as are those of *reptans*, but more deltoid, often almost an equilateral triangle in shape. The calyx of *villosum* is glandular-villous, especially toward base, and its margin glandular-ciliate (Fig. 2A).

In the field, *reptans* and *villosum* are so obviously different that they are readily distinguished. This has been emphasized more than once when the writer has been asked "what is the *Polemonium* in Adams County?" or told that one will not thrive under cultivation (as does *reptans*), or that "it is not worth growing, anyway." It is far less showy.

To demonstrate differences in pure populations of *reptans* and *villosum*, pictorialized scatter diagrams of the type devised by Anderson (1949, 1952, 1953) have been used (Fig. 4).

All parts of the plants of *villosum* are glandular-villous—pedicels and calyx, stems, and leaves. Such plants are represented on the pictorialized scatter diagram by solid dots, to contrast with the circles used for the essentially glabrous and non-glandular *reptans* (Fig. 4). Position of dots on this graph is based upon the ratio of length to width of median leaflets of cauline leaves, and upon pedicel-hair characters.

For the length : width ratio, the median pair of leaflets (or leaflets just below the middle, if number of pairs was even) of the lowest good cauline leaf were used. Cauline leaves near to the base of the stem and resembling basal leaves were rejected.

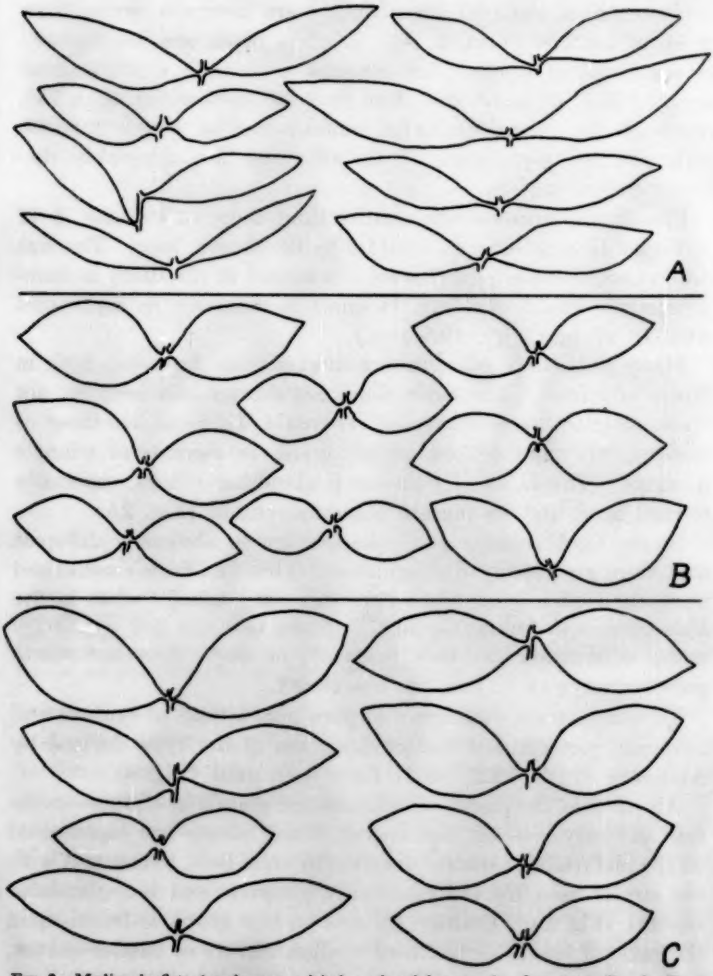

Fig. 3. Median leaflets (random sample) from basal leaves: A, of *reptans*, B, of *villosum*, and C, of a mongrel population.

The length and greatest width of both leaflets were measured, and the ratios obtained from the two leaflets averaged.

The pedicel score is based on length and character of hairs of the pedicel:

1. All hairs short and stubby, .05 mm. long; hairs short, but less blunt; or, occasional hairs to .2 mm. long scattered among short hairs.
2. Many hairs .25± mm., to some .3 mm.
3. Many hairs .3± mm. to some .4 mm.
4. Hairs .3, .5, and .7 mm., and also shorter hairs.
5. Many hairs .5 or .7 mm., some .8 or 1.0 mm., and also shorter hairs.

Hairs were measured by using an ocular scale ruled to half millimeters, using whole pedicels. Exact measurements on whole pedicels are not possible because hairs project at various angles. The use of smaller parts and higher magnification was impractical because of variation from place to place. Pedicels were scored in intermediate positions (as shown on the graph) in accordance with variations in length and dominance of particular lengths.

Characters used on the glyphs are ones which cannot be measured or scored as closely as can the length : width ratio or length and nature of pedicel hairs. Angles were measured by superimposing on the form to be measured paper sectors differing from one another by 15°, i.e., sectors 30°, 45°, 60°, 75°, 90°, 105°. Apical and basal leaf-angles often do not express the immediate tip or base of the leaflet, but rather the angle at which the margins converge toward apex or base. As margins are often slightly convex, the exact angle could not be measured.

Stem pubescence varies from base to inflorescence, and from internode to node. The three-score system used is:

1. Stems essentially glabrous, or with scattered hairs.
2. Hairs widely spaced on internodes, more closely placed near nodes or toward base of stem.
3. Hairs dense, or very dense, and long, some 1 mm. or sometimes 2 mm. long.

A three-score system was also used for leaves:

1. Leaves glabrous except for a few hairs in rachis groove or on petiole margin toward base, and except for a very small area of short hairs in concavity of base of midnerve of leaflets.
2. Rachis thinly pubescent, more densely so toward base.
3. Rachis villous; both leaf surfaces pubescent.

The complete separation on the diagram (Fig. 4) of glyphs representing flowering individuals of the *reptans* population from

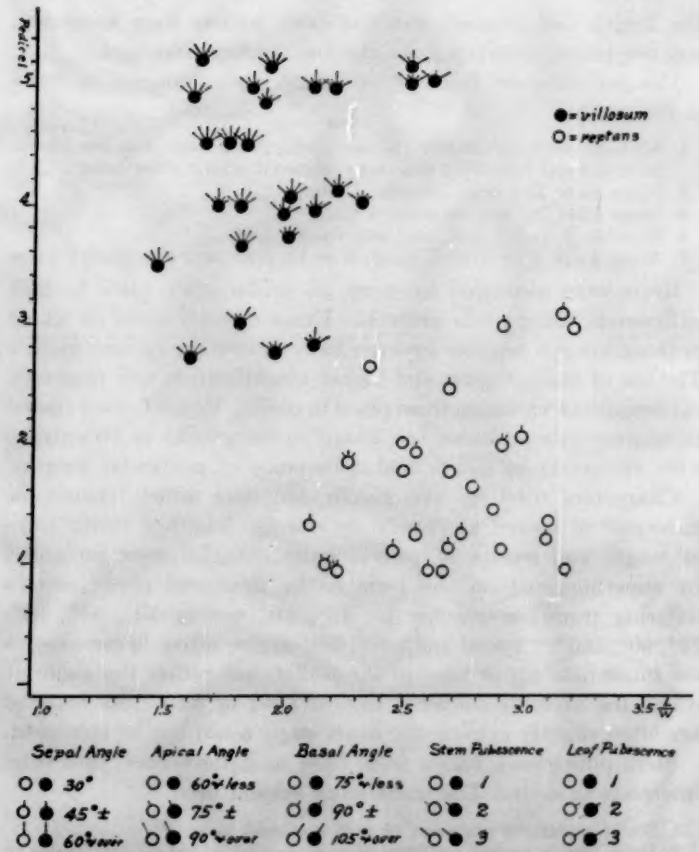

Fig. 4. Pictorialized scatter diagram of populations of *villosum* and *reptans*, based on characters of flowering plants collected in April. Horizontal axis: ratio of length to width of median leaflets of lowest good cauline leaf. Vertical axis: pedicel hairs, scored as described in text. Note complete separation of glyphs of the two populations.

those of the *villosum* population is evident. Almost as complete separation was seen on a diagram representing summer basal leaves, on which the glyphs were placed in relation to the length: width ratio and number of leaflets. Pubescence of leaf, and apical and basal angles were scored as in Fig. 4. Two entities were illustrated by these diagrams.

Some populations of *reptans* show slightly more variation than

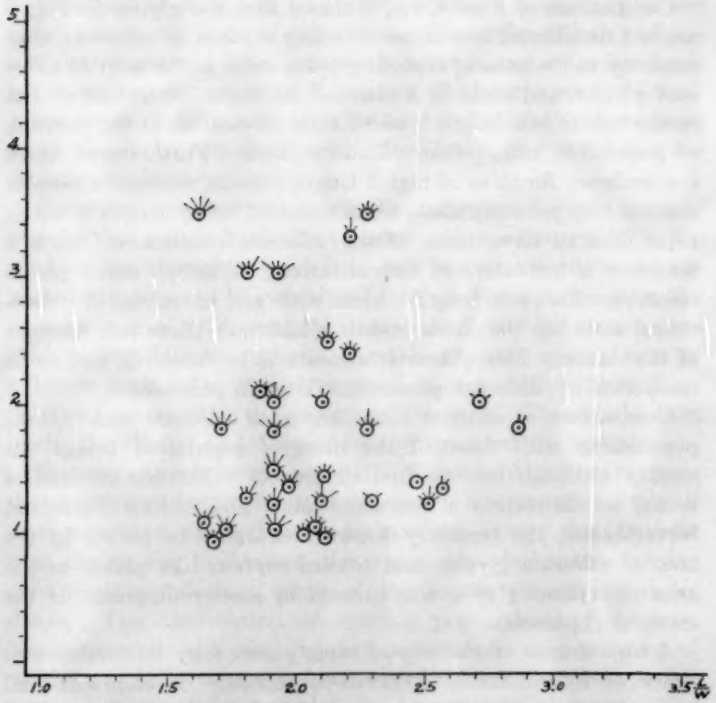

FIG. 5. Pictorialized scatter diagram of mongrel population, based on characters of flowering plants collected in April. Axes and glyph appendages as in Fig. 4.

the one illustrated by Fig. 4. Some herbarium specimens differ considerably from those of the population diagrammed, yet are obviously referable to *reptans*. What is the cause of this variation? Discovery of a mongrel population in which some plants resembled *reptans*, some resembled *villosum*, afforded an opportunity for analysis (Fig. 5). Open circles, with dot in center, are used in glyphs for this population, because such glands as may be present are inconspicuous and not evident under a 10× hand lens as are those of *villosum*. Although a few of the longer hairs are structurally similar to those of *villosum*, the gland appears to be non-functional and the conspicuous tip is absent. All glandular hairs deteriorate in summer, and it is not possible to distinguish functional and non-functional glands at this season.

Comparison of Figs. 4 and 5 shows that the glyphs in Fig. 5 are not distributed like those of either *reptans* or *villosum*, that some are in the area of *reptans* glyphs, some in the area of *villosum* glyphs, and some in a position not occupied by either, but in the belt of low length : width ratio as well as in the position of puberulent rather than villous pedicels. Furthermore, there is a tendency for those of higher length : width ratio to be simpler —more like pure *reptans*—while those of lower length : width ratio tend to have more of the *villosum* characters. Such a tendency is indicative of hybridization. Although many plants resemble *villosum* in length : width ratio and in amount of pubescence, none has the characteristic glandular-villous inflorescence of that taxon. This character appears to be recessive, and to be controlled by different genes than is stem pubescence.

Comparison of summer basal leaves of *villosum* and *reptans* populations with those of the mongrel population brings out similar although less marked differences. Number of leaflets is not as distinctive a character as is pedicel-hair character. Nevertheless, the tendency toward *villosum*-like plants in the area of *villosum* glyphs, and toward *reptans*-like plants in the area of *reptans* glyphs was present in scatter diagrams of the mongrel population.

A high degree of sterility of some plants may be further evidence of hybridization. Failure of capsule development and accompanying excessive enlargement of calyx was noted in several specimens among the random samples.

The "connection between hybridization and disturbed habitats" has been summarized by Anderson (1949). This mongrel population of *Polemonium* occupies an area where man has "hybridized the habitat," an area on a wooded slope steepened many years ago when a road was built in the valley at its base. Typical *reptans* may have grown in this valley; and perhaps typical *villosum* occupied some of the ravines. The nearest known pure populations of the latter are in other valleys some four to six miles distant in an air-line and separated by high hills which interpose ecologic barriers. Typical *reptans* is much more distant (Fig. 1). Anderson has stated "it is only where man or catastrophic natural forces have 'hybridized the habitat' that any appreciable number of segregates survives."

Hairiness of stem and leaf, and low length : width ratio are prominent in the mongrel population. Glandular-villous pedicels are almost absent. This is precisely what is seen when hundreds of herbarium specimens of *P. reptans* (inclusive) are examined. Some are pubescent, some have broader leaflets than others, some have the short, "squatty" form of *villosum*, but none has the glandular-villous pedicels.

Hybridization, such as is clearly indicated by the mongrel population analyzed, may have taken place infrequently in the past. Some characters have been lost, some retained, in the ensuing back-crosses. The results of introgressive hybridization are evident over a wide geographic area, but pure or almost pure *reptans* populations prevail. And large pure populations of *villosum* exist in a limited geographic area. Why have these not been swamped by the widespread *reptans?* This would seem likely if *villosum* had always been surrounded by *reptans*.

The suggestion is here made that *villosum* is older than *reptans*, that the now restricted range of *villosum* is a remnant of a former more extensive and perhaps more northern range; that at some time during the Pleistocene this range was decimated, leaving only those populations south of the immediate effects of ice sheets. The distribution of existing populations of *villosum* correlates well with the disjunct occurrences of a number of species generally interpreted as relic distribution. Biotype depletion is a usual accompaniment of restriction of range. The uniformity of populations of *villosum* and their failure to spread suggest such biotype depletion.

The progenitors of *villosum*, as of other species of *Polemonium*, are still more ancient. In a chart "showing the postulated affinities between the recognized entities in *Polemonium*," Davidson (1950) indicates that *P. reptans* is related to *P. delicatum* Rydb. and more distantly, to *P. pulcherrimum* Hook., both of which are western species. *P. delicatum* of the Rocky Mountains of Colorado, Utah, Arizona, and New Mexico, is a glandular-pubescent species, which suggests closer relationship to *villosum* than to *reptans*. Another pair of species (or subspecies) displays a comparable east-west relationship—*P. Van Bruntiae* Britt. of circumscribed eastern range and *P. occidentale* Greene of the western mountains. Such relationships must be ancient. *P.*

reptans, in the restricted sense, is a widespread species found almost throughout the Deciduous Forest (mostly north of the Coastal Plain), and northward into Minnesota, central Wisconsin, northern Vermont and New Hampshire. It is common in the glaciated territory. The ancestral stock, from which *villosum* and perhaps *delicatum* were early differentiated, probably gave rise to other variants, and later, perhaps in late Pleistocene, to the glabrous *reptans*. Other lines of development in *Polemonium* include both glabrous and pubescent forms. Rapid spread of the glabrous *reptans* in late Pleistocene and post-Pleistocene time brought it into proximity with some of the relic populations of *villosum*, resulting in occasional hybridization, wherever the two came into actual contact. Thus *reptans* acquired some of its variability. Analysis of the scatter diagram (Fig. 4) supports this contention.

If the ten individuals most like each other and the ten least like each other on the basis of the measurements used on the horizontal and vertical axes of the graph be selected for determining average ray value for the other five characters (zero for no ray, one for a short ray, two for a long ray), it is found that perfect *villosum* would have a score of ten, and perfect *reptans* a score of zero. Actually, the ten individuals of *villosum* to the upper left in the diagram have an average ray value of 9.0; the ten individuals of *reptans* to the lower right have an average ray value of 0.4, both of which values are close to the perfect score. The ten *villosum* closest to *reptans* have an average ray value of 7.8; the ten *reptans* closest to *villosum*, a value of 0.9. This means that all seven characters, the two on the axes and the five on the rays, are tending to go together. Comparable analysis of the diagram of the mongrel population (Fig. 5) shows that the ten most like *villosum* have an average ray value of 7.1 (lower than the lower value of the *villosum* population); the ten most like *reptans* have an average ray value of 3.5. That is, the average values are intermediate, and the same tendency of all characters to go together which is seen in Fig. 4 is illustrated here.

Only further studies of *P. reptans* throughout its range will make possible the determination of centers of variability, of clines which could be the result of introgressive hybridization, of contamination of the glabrous *reptans* stock with the glandular-

villous stock of *villosum*. Such clines would give clues to time and direction of migration. The most prominent appears to extend in general westward of the area of the *villosum* populations in southern Ohio; another, less marked, is evident in southeastern Pennsylvania, where pubescence of many plants suggests that a relic population of *villosum* once existed thereabouts.

This situation in the *Polemonium reptans* complex is comparable to that of the wild black cherries discussed by McVaugh (1951, 52)—a common and widespread taxon (*Prunus serotina* subsp. *serotina*) ranging almost throughout the Deciduous Forest, in both glaciated and unglaciated areas, and a highly localized taxon (*P. serotina* subsp. *hirsuta*) occurring in areas where there are other disjuncts and rare local endemics. This latter is interpreted as more ancient than the glabrous and widespread *serotina*, and more closely related to western subspecies. The entire range of this complex, as of many other phylads, is somewhat V-shaped, with an eastern and western arm. *Polemonium* has a range comparable to that of the *Prunus serotina* complex, with representatives in Mexico, the East, and the West.

In view of the distinctness of *reptans* and *villosum* demonstrated by the pictorialized scatter diagram (Fig. 4), it is evident they should be maintained as distinct taxa. For the present, then, *Polemonium reptans* includes the two distinct entities, *P. reptans* L. var. *reptans* and *P. reptans* L. var *villosum*, E. L. Braun. Whether the status of *villosum* should be changed to subspecies (which now appears suitable), or whether it should be maintained as a variety of *P. reptans* as originally described (1940) awaits further investigation. If the zoologist's definition of subspecies be accepted—"a geographically defined aggregate of local populations which differs taxonomically from other such subdivisions of the species"—then *villosum* is a subspecies, not a variety, which term is "limited to discontinuous variants within a single interbreeding population" (Mayr, Linsley, & Usinger, 1953). Certainly it is not a mere forma based on an "evanescent" character; it forms pure populations.—UNIVERSITY OF CINCINNATI.

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A SECOND LIST OF FRESHWATER ALGAE CHIEFLY FROM NEW BRUNSWICK

HERBERT HABEEB AND FRANCIS DROUET

This paper is a continuation of the work initiated in 1947, and reported upon in RHODORA Vol. 50, March, 1948.

The material dealt with in this paper was collected during the years 1948–1951. In the winter of 1948–49 collections were made right through the cold months to show that the algal flora of our rivers and brooks is active the year round. In collections made from Little River and several brooks in the vicinity of Grand Falls during January and February of 1949, the following species are worth noting; *Batrachospermum moniliforme, Calothrix parietina, Chlorotylium cataractarum, Draparnaldia plumosa, Entophysalis rivularis, Leptosira Mediciana, Phormidium autumnale, P. purpurascens, P. Setchellianum, P. uncinatum, Rivularia haematites, R. rufescens, Rhizoclonium hieroglyphicum, Tetraspora gelatinosa, Tolypothrix penicillata,* and *Spirogyra Grevilleana*.—This last being in a sterile state.

The determinations were all made by Francis Drouet except that several numbers of *Characeae* were kindly determined for us by Mrs. Fay K. Daily, and that the naming of the *Zygnemataceae* is the responsibility of Herbert Habeeb. In this connection, it may be well to mention that all the species reported in this list are based upon dried herbarium macrospecimens. We are grateful to Rev. Irénée-Marie for his careful examination of two of the numbers for desmids. This resulted in his description of the novelty, *Staurastrum Habeebense*, from small ledge pools in the canyon at Grand Falls, New Brunswick.

The collection numbers given are those of Herbert Habeeb. Complete sets of the specimens are in the possession of the Cryptogamic Herbarium, Chicago Natural History Museum, and in the collections of Herbert Habeeb and Francis Drouet. Many of the numbers will be found duplicated in other herbaria.

Unless otherwise indicated, the specimens are from Victoria County, New Brunswick. A number of specimens are included that were collected in adjacent Aroostook County, Maine; these are indicated by placing "Maine" after the collection number. Also listed are a number of specimens from Mt. Albert in the

Gaspé region of Québec; these are indicated by placing "Gaspé" after the number. Some species from our first list of New Brunswick algae are again included to show recent changes in nomenclature and present appropriate synonymy.

Agmenellum thermale (Kütz.) Dr. & Daily. synonyms: *Merismopoedia thermalis* Kütz. collection numbers: 10940. 10982. In a brooklet.

Anabaena oscillarioides Bory. 10430. Wet swamp bottom.

A. variabilis Kütz. 11682, Albert County. 11345, Maine. 11468, Maine. In a ledge pool. In a ditch. On exposed mud of a pond.

Anacystis dimidiata (Kütz.) Dr. & Daily. *Gloeocapsa dimidiata* (Kütz.) Dr. & Daily. *G. turgida* (Kütz.) Hollerb. 10582. 11414 in part. 11620 in part, Madawaska County. Ledge pool. Shore of a lake. In a pond.

A. montana (Lightf.) Dr. & Daily. *Gloeocapsa alpicola* (Lyngb.) Born. 1792, Gaspé. 10456. 10476. 10556. 10558. 10586. 10646. 10687. 10704. 11474, York County. 11581, York County. 11582 in part, York County. 11651. 11672 in part. 11673 in part. 11674 in part. 11683 in part, Albert County. On ledge and canyon wall. In ledge pools. On vegetation in a brooklet. Off a twig in a lake. On a boulder near a spring. On a concrete water-tub at a spring. On a rock in a lake, top Mt. Albert.

A. montana, f. minor (Wille) Dr. & Daily. 11491. In a shallow ledge pool.

A. thermalis (Menegh.) Dr. & Daily. *Gloeocapsa minuta* (Kütz.) Hollerb. *G. membranina* (Menegh.) Dr. & Daily. 10671. 10966 in part. 11414 in part. In ledge pools. Shore of a lake.

A. thermalis, f. major (Lagerh.) Dr. & Daily. *Gloeocapsa limnetica* (Lemm.) Hollerb. 11657 in part. In a lake.

Ankistrodesmus falcatus (Corda) Ralfs. 10623. 10663 in part. On ledge above river surface. In a ledge pool.

Aphanochaete repens A. Br. 10368. 10627. 10706. In ledge pools. Bog part of a small lake.

Aulosira implexa B. & F. 10772. On wet ground.

Bulbochaete minor A. Br. 10332. In a ledge pool.

Calothrix parietina (Näg.) Thur. *Calothrix parietina* B. & F. 1778, Gaspé. On debris in a pool, top Mt. Albert.

Capsosiphon fulvescens (Ag.) Setch. & Gard. 13475, Sussex County. In a well at the salt springs, Sussex.

Chaetophora incrassata (Huds.) Haz. 10347. 10613. 10839. 11206. 11208. 11538. 11625. On vegetation, rocks, etc. in lakes, brooks and ponds.

Chara globularis Thuill. 11543. In a lake. Determined by Mrs. Fay K. Daily.

Cladophora crispata (Roth) Kütz. 1966, Gaspé. In a falls, 10½ miles "North" of the hotel at Mt. Albert.

Coccochloris elabens (Bréb.) Dr. & Daily. 10349. 11157. 11414 in part. 11437. 11522. 11650. 11655. 11657 in part. In lakes.

C. Peniocystis (Kütz.) Dr. & Daily. 11087. In a lake.

C. stagnina Spreng., *Anacystis rupestris* (Lyngb.) Dr. & Daily. 10917. 10927. 11218. 11416. In a ledge pool. On ledge near falls. In lakes.

Coleochaete scutata Bréb. 11623. On clam shells in a lake.

Cylindrocystis cylindrospora (Bréb.) Dr. & Daily. *Cylindrocystis Brebissonii* Menegh. 1779 in part, Gaspé. 10521. 10573. 10575. 11264. 11269. 11270. 11271. 13429 in part. In ledge pools. Ditches. Shore of a small lake, top Mt. Albert.

Desmidium Swartzii Ag. 10518. 10599, Maine. Wet bog. In a small pond.

Dichothrix Orsiniana (Kütz.) B. & F. 11494. 13403 in part. In trickling water on a ledge. In a ledge pool.

Entophysalis Lemaniae (Ag.) Dr. & Daily. *Entophysalis Brebissonii* (Menegh.) Dr. & Daily. 10407 in part. On rocks in a brooklet.

E. rivularis (Kütz.) Dr. *Chamaesiphon polonicus* (Rostaf.) Hansg. 1967, Gaspé. 10424 in part. 10425, in part. 10447. 10453. 10500 in part. 10562. 10658. 10667. 10707 in part. 10957 in part. 10993. 11016. 11108. 13353 in part. 13372. 13373. 13375. 13405. 11480 in part, York County. On wet ledges. Ledge pools. On rocks, etc. in brooks. On ledge in a falls 10½ miles "North" of the hotel at Mt. Albert.

E. rivularis, f. papillosa (Kütz.) Dr. & Daily. 11446. 11681, Albert County. On wall of a garden pool. On rocks in a spring.

Eremosphaera viridis DeBary. 11171. In a pond.

Fischerella ambigua (Näg.) Gom. *Fischerella ambigua* (B. & F.) Gom. 1783, Gaspé. Between wet stones, top Mt. Albert.

Gloeotrichia Pisum (Ag.) Thur. 11399. 11609. 11611 in part. 11624. In a pond. On moss and clam shells in a lake.

Gomphosphaeria aponina Kütz. 11463, Madawaska County. 11466, Madawaska County. 11620 in part, Madawaska County. In a pond.

G. lacustris Chod. 10849. In a pool of a brooklet.

Gongrosira Debaryana Raben. 10472. 10954. 11177. 13482, Sussex County. On rocks, etc. in springs and brooks.

Hapalosiphon fontinalis (Ag.) Born. *Hapalosiphon pumilus* (Kirchn.) B. & F. 1790 in part, Gaspé. 1791, Gaspé. 1807 in part, Gaspé. 1899 in part, Gaspé. On wet ground, wet ledges, in tiny lakes, top Mt. Albert.

Hormotila mucigena Borzi. 10963. On rock in a brook.

Hyalotheca dissiliens (Sm. & Sow.) Bréb. 11150, Maine. 11210. 11220 in part. 11590, Maine. In a ditch. Ponds. Lake shore.

H. mucosa (Dillw.) Ehrenb. 11336. In a river.

Palmella Myosurus (Ducluz.) Lyngb. *Hydrurus foetidus* (Vill.) Trevis. 10420. 10454. 10661. 11680, Albert County. In a ledge pool. In brooklets and springs.

Leptosira Mediciana Borzi. 11012. On a rock in a brooklet.

Lyngbya Diguetii Gom. 13471 in part, Sussex County. Well at the salt springs, Sussex.

L. versicolor (Wartm.) Gom. 10742. 11626. 11673 in part. In a ledge pool. Off wood in a lake. On concrete water-tub at a spring.

Mesotaenium rubescens (Bréb.) Dr. & Daily. *Mesotaenium macrococcum* (Kütz.) Roy. 1787, Gaspé. 10555. 11546, Madawaska County. 11675. In a ledge pool. On concrete water-tub at a spring. On bare ground. On ground, top Mt. Albert.

Microcoleus rupicola (Tild.) Dr. 10623 in part. 10633. 10910 in part. 11117. 13474 in part, Sussex County. On ground and ledges along rivers. On salty mud at the salt springs, Sussex.

Microspora amoena (Kütz.) Rabenh. 11106. In a brook.

Mougeotia laetevirens (A. Br.) Wittr. 11536. 11615. In a lake.

Netrium digitus (Ehrenb.) Itzigs. & Rothe. 10527. 10971. 11338 in part. 13398. Bog end of a lake. Ledge pool. In a brooklet. In a river.

N. interruptum (Bréb.) Lutkem. 11400 in part. 11401. In a pond.

Nitella flexilis Ag. 10888, York County. In the St. John River, Fredericton. Determined by Mrs. Fay K. Daily.

Nostoc commune Vauch.? 1744, Gaspé. On ledge, top Mt. Albert.

N. pruniforme (L.) Ag. 11158. 11159. 11436. 11457. In lakes.

N. microscopium Carm. *Nostoc microscopicum* B. & F. 1921, Gaspé. 1925, Gaspé. 1926, Gaspé. 1934, Gaspé. 1991, Gaspé. 1992, Gaspé. On mosses and hepatics in a ditch 2 miles "North" of the hotel at Mt. Albert. On mosses, swampy ground, 2 miles "North" of Cap-Chat.

N. sphaericum Vauch. 10583. 11438. 11458. 11520. 11654. In lakes. Ledge pool.

N. verrucosum Vauch.? 1919, Gaspé. On a boulder, Mt. Albert.

Oocystis Borgei Snow. 10381 in part. On wet ledge.

O. crassa Wittr. 10656. In a ledge pool.

Ophiocytium cochleare (Eichw.) A. Br. 1788, Gaspé. 10363 in part. 11168. 11306, Maine. In ponds. Bog end of a lake. Bottom of a tiny pool, top Mt. Albert.

O. parvulum (Perty) A. Br. 11069 in part, Maine. 11074, Maine. 11079, Maine. 11081, Maine. 11223. 11249 in part, Madawaska County. 11398. In ponds, ditches, etc.

Oscillatoria amoena (Kütz.) Gom. 10426. 10625. 10828. 11103. 11211. 11289. 11424. 11515 in part. 11578 in part. 11601. 11631. 11638. 13380. 13381. 13414. On rocks, gravel, ledges, etc. in brooks and rivers.

O. anguina (Bory) Gom. 10364 in part. 11439 in part. 11440. 11459. In a lake. Bog end of a lake. Pool on shore of a lake.

O. articulata Gardn. 10850. 10673. In a ledge pool. Bottom of a pool on a brooklet.

O. chlorina (Kütz.) Gom. 10343 in part. 10355 in part. In lakes.

O. CURVICEPS Ag. 11391. In a pond on a brook.

O. GRANULATA Gardn. 10364 in part. 11434 in part. In a lake. Bog part of a lake.

O. IRRIGUA (Kütz.) Gom. 10342. 10353 in part. 10477. 10595, Maine. 10942. 10969 in part. 11004. 11413. 11435. 11441. 11539. 11540. 11597? 11602? In lakes. In brooklets. Pond on a brooklet.

O. LIMOSA (Roth) Ag. 10777. 10779. On bottom and floating in an inlet to the St. John River.

O. ORNATA (Kütz.) Gom. 11161. In a lake.

O. PRINCEPS Vauch. 10342 in part. 10343 in part. 11252, Madawaska County. 11411. 11439 in part. 11443 in part. 11451. 11452. In a pond. In lakes.

O. SIMPLICISSIMA Gom. 11207. 11214. In lake. Pool on shore of a lake.

O. SPLENDIDA Grev. 10526. 10549. 11531, Maine. 11553. 11554. 11559. 11562. In a bog. In ponds and lakes.

O. TENUIS, var. TERGESTINA (Kütz.) Rabenh. 10341 in part. 10353 in part. 10355. 11180, Maine. 11198, Maine. In lakes. In a ditch. Brooklet from a swamp.

PALMOGLOEA PROTUBERANS (Sm. & Sow.) Kütz. *Gloeocystis Grevillei* (Berk.) Dr. & Daily. *G. confluens* (Kütz.) Richt. 1743 in part, Gaspé. 1745, Gaspé. 1746, Gaspé. 1757, Gaspé. 1769, Gaspé. 1785 in part, Gaspé. 1786, Gaspé. 1807, Gaspé. 1946, Gaspé. 1964, Gaspé. 1984, Gaspé. 1987, Gaspé. 2034, Gaspé. On wet ledge, on moss, on peat, in a small lake, etc., top Mt. Albert. On a boulder in a ditch, 2 miles "North" of the hotel at Mt. Albert. On ledge at a falls, 10½ miles "North" of the hotel at Mt. Albert. In falls of a brook, 4 miles "North" of Cap-Chat. On moss on a stump, 2 miles "North" of Cap-Chat. On moss on a ledge near the St. Lawrence River, 3 miles "North" of Grosses Roches, Matane County.

PENIUM MARGARITACEUM (Ehrenb.) Bréb. 11408 in part. In a pasture pond.

PHORMIDIUM INUNDATUM Kütz. 10977. 13371 in part. 11307, Maine. On ledge in a brook. On a log in a brooklet. In a pond.

P. PURPURASCENS (Kütz.) Gom. 10307. 11007a. 11596. 11291. In a brooklet.

P. RETZII (Ag.) Gom. 11298, Maine. 11557. On rocks in a brooklet. In a lake outlet.

P. VALDERIANUM Gom. 11093 in part. 11094 in part. 11097. 11098. 11102 in part. In water near shore of a lake, and in a nearby spring pool.

PLECTONEMA NOSTOCORUM Born. *Plectonema Nostocorum* Gom. 1927, Gaspé. Off moss in a ditch, 2 miles "North" of the hotel at Mt. Albert.

P. TOMASINIANUM (Kütz.) Born. 11037. On rocks in Little River.

PLEUROTAENIUM TRABECULA (Ehrenb.) Näg. 10411. Pond on a brooklet.

RHIZOCLONIUM HIEROGLYPHICUM (Ag.) Kütz. 10720. 11008. 11023.

11030. 11619, Madawaska County. In trickling water in canyon. In brooklets. In a pond.

R. RIPARIUM (Roth) Harv. 13471, Sussex County. 13472, Sussex County. In wells at the salt springs, Sussex.

RIVULARIA HAEMATITES (DC.) Ag. 10992. On rock in a brooklet.

R. MINUTULA (Kütz.) B. & F. 10755. 11610. On ledges and rocks in Little River. On rocks in a pond.

R. RUFESCENS (Näg.) B. & F. 11029. 11032. 11508. On rocks and ledge in springs and brooklets.

SCENEDESMUS BIJUGA (Turp.) Lagerh. 10579. 10697. 10929. 11535, Maine. 11603, Maine. In ledge pools. Permanent puddle. Roadside pool.

SCHIZOCHLAMYS AURANTIA (Ag.) Dr. & Daily. *Schizochlamys gelatinosa* A. Br. 11153, Maine. 11524. 11656. In a lake. On vegetation in swamp water.

SCHIZOTHRIX ARENARIA (Berk.) Gom. 10770. 10920. On ledge near falls, and on rocks in the St. John River.

S. CALCICOLA (Ag.) Gom. 10375. 10738. Ledge pools.

S. DAILYI Dr. 10425 in part. In a brooklet.

S. LACUSTRIS A. Br. *Schizothrix lacustris* Gom. 1794, Gaspé. Border of a tiny pool, top Mt. Albert.

S. LAMYI Gom. 1749, Gaspé. 1785 in part, Gaspé. On peat, shore of a small lake, top Mt. Albert.

S. LARDACEA (Ces.) Gom. 10967. 11561 in part. 11664 in part. On a boulder, shore of a lake. Side of a ledge pool. On wet wood in a lake outlet.

S. LATERITIA (Kütz.) Gom. 10928. In a ledge pool.

S. MELLEA Gardn. 1742 in part, Gaspé. 1776, Gaspé. In a water trickle on a ledge, top Mt. Albert. On peat, shore of a small lake, top Mt. Albert.

S. MUELLERI Näg. 11486 in part, York County. On ground in forest.

S. PURPURASCENS (Kütz.) Gom. 11486 in part, York County. On ground in forest.

SCYTONEMA DENSUM (A. Br.) Born. 1752, Gaspé. On wet ledge, top Mt. Albert.

S. MIRABILE (Dillw.) Born. *Scytonema figuratum* B. & F. 1742 in part, Gaspé. In a water trickle on a ledge, top Mt. Albert.

S. TOLYPOTRICHOIDES Kütz. 11442. 11636. In a brooklet. Lake shore.

SPHAERELLA LACUSTRIS (Girod.) Wittr. 1750, Gaspé. On rocks in a tiny pool, top Mt. Albert.

SPIROGYRA CATENAEFORMIS (Hass.) Kütz. (Also spelled CATENIFORMIS). 10780. 10781. 10812. 10820. 10837. 10841. 10846 in part. 10939. 11068, Maine. 11073, Maine. 11176. 11287. 11384, Restigouche County. 11385, Restigouche County. 11447? 11594 in part. In brooklets, freshwater pools, springs, ponds, etc.

S. COMMUNIS (Hass.) Kütz. 11349, Maine. In a pond.

S. CONDENSATA (Vauch.) Kütz. 11277. 11278. 11279. 11280. 11281 in part. 11282. 11341. Inlet of the Tobique River. Pond, bed of the Tobique River. In a spring, shore of the Tobique River.

S. CRASSA Kütz. 11430 in part. 11444 in part. 11465, Madawaska County. In lakes and ponds.

S. DUBIA Kütz. 10530. 10533. 10543. 10545. 10547. 10548. 10594, Maine. 11350, Maine. 11351 in part. 11429 in part. 11456, Maine. In a ditch. Lakes and artificial ponds.

S. FLUVIATILIS Hilse. 10915. 10925. 10926. 11110. 11472, Maine. 11495. In a ledge pool. On and between rocks in a pond outlet, Caribou.

S. GRACILIS (Hass.) Kütz. 11137 in part, Maine. 11235, Maine. 11309 in part, Maine. In a pond. Ditches.

S. GREVILLEANA (Hass.) Kütz. 10930. 10989. 11066 in part, Maine. 11067 in part, Maine. 11113, Maine. 11138 in part, Maine. 11142, Maine. 11304, Maine. In a ledge pool. Brooklet. In ditches.

S. HANTZSCHII Rabenh. 11147, Maine. 11183, Maine. 11293, Maine. 11342, Maine. 11343, Maine. In a ditch.

Our material is a perfect match with the type itself except for the ornamentation of the inner membrane of the spores. In all probability, our material was not ripe enough to show an ornamentation of the inner membrane.

S. INFLATA (Vauch.) Kütz. 10490. 11066 in part, Maine. 11067 in part, Maine. 11138 in part, Maine. 11141, Maine. 11400 in part. In a pond. Freshwater pool. In ditches.

S. JUERGENSII Kutz.? 10819. In a ledge pool.

S. LONGATA (Vauch.) Kütz. 11136, Maine. 11139, Maine. 11348, Maine. 11351 in part, Maine. 11392 in part. In ponds.

S. MAXIMA (Hass.) Wittr. 11430 in part. 11433. 11444 in part. 11445. In a lake.

S. NEGLECTA (Hass.) Kütz. 10600, Maine. 10601, Maine. 10906. 11167. 11173. 11174. 11175. 11319. 11393. 11394. 11395. 11429 in part. 11616, Maine. Common in artificial ponds forming dense floating mats.

S. MAJUSCULA Kütz. *Spirogyra orthospira* (Näg.) Kütz. 11412. 11454. In a lake.

S. WEBERI Kütz. 11118. 11228. 11257, Madawaska County. 11258, Madawaska County. 11259, Madawaska County. 11299, Maine. 11403. In ponds. Ledge pool. Slow part of a brooklet.

STIGONEMA MAMILLOSUM (Lyngb.) Ag. 10515 in part. In a lake.

S. PANNIFORME (Ag.) B. & F. 1742 in part, Gaspé. 1777, Gaspé. 1779 in part, Gaspé. 1790 in part, Gaspé. 1793, Gaspé. 1797, Gaspé. 1807 in part, Gaspé. On wet ledge, pool bottom, shore of a small lake, and in a tiny lake, top Mt. Albert.

SYMPLOCA DUBIA (Näg.) Gom. 11489. On ledge in falls.

S. MURALIS Kütz. 10692 in part. 11686, Albert County. 11517. In ledge pools. With *Philonotis* sp. on a damp ledge.

Tetmemorus granulatus (Bréb.) Ralfs. 11322. In a ditch.

Tetraedron minimum (A. Br.) Hansg. 10557. 10570. Ledge pools.

Tribonema bombycinum, f. tenue Haz. 11146, Maine. In a ditch.

Tolypothrix distorta (Hofm.-Bang) Kütz. 10522. Bog shore of a lake.

T. lanata (Desv.) Wartm. 10362. 11164. 11418. Lake and bog part of lake. In a swamp pool.

T. penicillata (Ag.) Thur. 10407 in part. 10471. 10489. 10788. 10956. 10974. 11005. 11035. 11038. 11044. 11048. 11488. On rocks and ledge in Little River and its tributaries.

T. tenuis Kütz. 10515 in part. 11163. 13477, Sussex County. 11498. 11611 in part. 11622. 11627. 11628. On clam shells, vegetation, etc. in lakes. In a well at the salt springs, Sussex.

Ulothrix implexa Kütz. 13478, Sussex County. Salt springs, Sussex.

Vaucheria aversa Hass. 11085, Maine. 11302, Maine. 11311, Maine. In ditches.

V. geminata, var. racemosa (Vauch.) Walz. 11111. 11308 in part, Maine. 11370, Restigouche County. In a brook. Small pond. In a ditch.

Zygnema cyanosporum Cleve? 11337. 11634. In a spring. In a pool, bed of Little River.

Z. decussatum (Vauch.) Ag. 11292 in part. In a brooklet.

Z. insigne (Hass.) Kütz. 11570. 11588, Maine. 11589, Maine. In a ditch. Pasture pool.

Z. pectinatum (Vauch.) Ag. 11281 in part. 11292 in part. 11340. In a brooklet. Inlet of the Tobique River.

Zygogonium ericetorum Kütz. 1795, Gaspé. 10663 in part. 10664. 10665. 11420. Path surface through a bog. Ledge pools. In a flowway between pools, top Mt. Albert.—Grand Falls, New Brunswick, and the Chicago Natural History Museum.

ELEVENTH REPORT OF THE COMMITTEE ON PLANT DISTRIBUTION

The tenth report concluded the *Monocotyledoneae*. The present report begins with the *Dicotyledoneae* and includes the families through *Moraceae*, taken in the order of the eighth edition of Gray's Manual. Unlike any of the previous reports the plants included here are all trees and shrubs with the exception of *Saururus*.

The data for these reports have been compiled chiefly from the herbarium of the New England Botanical Club and the herbarium of the Arnold Arboretum and Gray Herbarium.

Preliminary Lists of New England Plants — xxxvi

The sign + indicates that an herbarium specimen has been seen, the sign — that a reliable printed record has been found and the sign * is used for those plants which are not native in our flora.

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
SAURURACEAE						
Saururus cernuus L.					+	+
SALICACEAE						
Populus alba L.	*	*	*	*	*	*
Populus balsamifera L.	+	+	+	+	+	+
Populus balsamifera var. subcordata Hylander	+		+			
Populus canescens (Ait.) Sm.						*
Populus deltoides Marsh.	+	+	+	+	+	+
Populus deltoides var. missouriensis (Henry) Rehd.						+
Populus × gileadensis Rouleau (balsamifera × deltoides)	+	+	+	+	+	+
Populus grandidentata Michx.	+	+	+	+	+	+
Populus heterophylla L.						+
Populus nigra L. var. italica Muenchh.	*	*	*	*	*	*
Populus tremuloides Michx.	+	+	+	+	+	+
Populus tremuloides var. magnifica Vict.	+	+				
Populus tremuloides f. pendula Jaeger and Beisner	+					
Populus tremuloides f. reniformis Tidestr.	+					+
Salix alba L.	*	*	*	*		*
Salix alba var. calva G. F. W. Mey.	*	*	*	*		*
Salix alba var. vitellina (L.) Stokes	*	*	*	*	*	*
Salix alba × fragilis	*	*	*	*	*	*
Salix amygdaloides Anderss.			−	+		
Salix arctophila Cockerell	+					
Salix argyrocarpa Anderss.	+	+				

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Salix babylonica L.			*	*		*
Salix Bebbiana Sarg.	+	+	+	+	+	+
Salix Bebbiana var. caprefolia Fern.						+
Salix Bebbiana × discolor				+		
Salix Bebbiana × gracilis				+		
Salix Bebbiana × rigida				+		
Salix candida Flügge	+		+	+		+
Salix candida f. denudata (Anderss.) Rouleau			+	+		+
Salix candida × Bebbiana				+		
Salix candida × gracilis				+		
Salix candida × rigida				+		
Salix Caprea L.						*
Salix cinerea L.				*		
Salix cinerea × rigida				+		
Salix coactilis Fern.	+					
Salix cordata Michx.	−			−		
Salix cordata var. abrasa Fern.	+					
Salix discolor Muhl.	+	+	+	+	+	+
Salix discolor var. latifolia Anderss.	+	+		+	+	+
Salix discolor var. Overi C. R. Ball	+					
Salix discolor × humilis	+	+	+	+	+	
Salix fragilis L.	*	*	*	*	*	*
Salix glaucophylloides Fern.	+					
Salix glaucophylloides f. lasioclada Fern.	+					
Salix gracilis Anderss.	+	+	+	+		+
Salix gracilis var. textoris Fern.	+	+	+	+	+	+
Salix gracilis × humilis var. microphylla				+		
Salix gracilis × sericea				+		
Salis × Grayi Schneid. (argyrocarpa × planifolia)		+				
Salix herbacea L.	+	+	−			
Salix humilis Marsh.	+	+	+	+	+	+
Salix humilis var. hyporhysa Fern.						+
Salix humilis var. keweenawensis Farw.	+	+	+			
Salix humilis var. microphylla (Anderss.) Fern.	+	+		+	+	+
Salix humilis f. curtifolia Fern.				+		
Salix humilis f. festiva Fern.				+		
Salix humilis f. tortifolia Fern.				+		
Salix humilis × gracilis				+		
Salix humilis × sericea				+		+
Salix humilis × humilis var. microphylla				+		
Salix incana Schrank	*					
Salix interior Rowlee	+	+	+	+		
Salix interior var. exterior Fern.	+					
Salix interior f. Wheeleri (Rowlee) Rouleau						+
Salix × Jesupi Fern. (alba × lucida)						+
Salix lucida Muhl.	+	+	+	+	+	+
Salix lucida var. angustifolia Anderss.	+	+	+			
Salix lucida var. intonsa Fern.	+	+	−	+		
Salix × myricoides (Muhl.) Carey (rigida × sericea)	+	+	+	+	+	+
Salix nigra Marsh.	+	+	+	+	+	+
Salix × Peasei Fern.		+				

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Salix pedicellaris Pursh	+		+			
Salix pedicellaris var. hypoglauca Fern.	+	+	+	+		+
Salix pedicellaris var. tenuescens Fern.	+	+		+		
Salix pellita Anderss.	+	+	+			
Salix pellita f. psila Schneid.	+					
Salix pentandra L.	•	•	•	•	•	•
Salix planifolia Pursh	+	+	+			
Salix purpurea L.	•	•	•	•	•	•
Salix pyrifolia Anderss.	+	+	+			
Salix pyrifolia × discolor	+					
Salix rigida Muhl.	+	+	+	+	+	+
Salix rigida var. angustata (Pursh) Fern.	+	+	+	+		+
Salix rigida f. mollis (Palmer and Steyerm.) Fern.			+	+	+	+
Salix rigida × discolor	+			+		
Salix rigida × gracilis	+			+		
Salix rigida × lucida				+		
Salix rigida × pedicellaris				+		
Salix rigida × subsericea				+		
Salix × rubens Schrank (alba × fragilis)	•	•	•	•	•	•
Salix sericea Marsh.	+	+	+	+	+	+
Salix serissima (Bailey) Fern.			+	+		+
Salix × subsericea (Anderss.) Schneid. (gracilis var. textoris × sericea)	+		+	+		+
Salix × Smithiana Willd. (viminalis × caprea)	•			•		
Salix Uva-ursi Pursh	+	+	+			
Salix Uva-ursi f. lasiophylla Fern.		+				
Salix viminalis L.	•		•	•		
MYRICACEAE						
Comptonia peregrina (L.) Coult.	+	+	+	+	+	+
Myrica Gale L.	+	+	+	+	+	+
Myrica Gale var. subglabra (Chev.) Fern.	+	+	+	+	+	+
Myrica pensylvanica Loisel.	+	+		+	+	+
JUGLANDACEAE						
Carya cordiformis (Wang.) K. Koch		+	+	+	+	+
Carya glabra (Mill.) Sweet		+	+	+	+	+
Carya ovalis (Wang.) Sarg.	+	+	+	+	+	+
Carya ovalis var. hirsuta (Ashe) Sarg.				+	+	
Carya ovalis var. obcordata (Muhl. and Willd.) Sarg.				+		
Carya ovalis var. obovalis Sarg.				+		
Carya ovata (Mill.) K. Koch	+	+	+	+	+	+
Carya ovata var. Nuttallii Sarg.		+				
Carya ovata var. pubescens Sarg.		+				
Carya tomentosa Nutt.		+	−	+	+	+
Juglans cinerea L.	+	+	+	+	+	+
Juglans nigra L.			−	+	+	+
CORYLACEAE						
Alnus crispa (Ait.) Pursh	+	+	+			
Alnus crispa var. mollis Fern.	+	+	+	+	+	
Alnus glutinosa (L.) Gaert.				•		
Alnus rugosa (DuRoi) Spreng.	+	+	+	+	+	+
Alnus rugosa f. Emersoniana Fern.	+	+	+	+	+	+
Alnus rugosa var. americana (Regel) Fern.	+	+	+	+		

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Alnus rugosa var. americana f. hypomalaca Fern.	+	+	+	+		
Alnus rugosa var. americana f. tomophylla Fern.	+					
Alnus serrulata (Ait.) Willd.	+	+	+	+	+	+
Alnus serrulata f. noveboracensis (Britt.) Fern.				+	+	
Alnus serrulata var. subelliptica Fern.		+	+	+	+	+
Alnus serrulata var. subelliptica f. emarginata Fern.						+
Alnus serrulata var. subelliptica f. mollescens Fern.				+		+
Betula alba L.				•		
Betula borealis Spach			+			
Betula × caerulea Blanch. (populifolia × caerulea-grandis)			+	+		
Betula caerulea-grandis Blanch.	+	+	+			
Betula glandulosa Michx.	+	+				
Betula lenta L.	+	+	+	+	+	+
Betula lenta f. laciniata Rehd.		+				
Betula lutea Michx. f.	+	+	+	+	+	+
Betula lutea var. macrolepis Fern.	+	+	+	+	+	+
Betula minor (Tuckerm.) Fern.	+	+	−			
Betula nigra L.		+		+		+
Betula papyrifera Marsh.	+	+	+	+	+	+
Betula papyrifera var. commutata (Regel) Fern.	+	+		+		
Betula papyrifera var. cordifolia (Regel) Fern.	+	+	+	+	+	+
Betula papyrifera var. macrostachya Fern.	+					
Betula papyrifera var. pensilis Fern.	+					
Betula papyrifera × populifolia				+		
Betula pendula Roth		•		•		
Betula populifolia Marsh.	+	+	+	+	+	+
Betula populifolia f. incisifolia Fern.				+		
Betula pumila L.	+			+		+
Carpinus caroliniana Walt. var. virginiana (Marsh.) Fern.	+	+	+	+	+	+
Corylus americana Walt.	+	+	+	+	+	+
Corylus americana f. missouriensis (A. DC.) Fern.		+	+	+	+	+
Corylus cornuta Marsh.	+	+	+	+	+	+
Corylus heterophylla Fisch.						•
Ostrya virginiana (Mill.) K. Koch	+	+	+	+	+	+
Ostrya virginiana var. lasia Fern.				+		
FAGACEAE						
Castanea dentata (Marsh.) Borkh.	+	+	+	+	+	+
Castanea pumila (L.) Mill.				+		
Fagus grandifolia Ehrh.	+	+	+	+	+	+
Fagus grandifolia f. pubescens Fern. and Rehd.				+		
Fagus grandifolia var. caroliniana (Loud.) Fern. and Rehd.				+		
Fagus sylvatica L.				•		
Fagus sylvatica var. atropurpurea West.				•		
Quercus alba L.	+	+	+	+	+	+
Quercus alba f. latiloba (Sarg.) Palmer and Steyerm.	+	+	+	+	+	+

	Me.	N. H.	Vt.	Mass.	R. I.	Conn.
Quercus alba f. repanda (Michx.) Trel.	+			+		
Quercus × Bebbiana Schneid. (alba × macrocarpa)			+			
Quercus bicolor Willd.	+	+	+	+	+	+
Quercus coccinea Muenchh.	+	+	+	+	+	+
Quercus × Faxoni Trel. (alba × prinoides)				+		
Quercus × Fernowi Trel. (alba × stellata)				+		
Quercus ilicifolia Wang.	+	+	+	+	+	+
Quercus imbricaria Michx.				•		
Quercus × Leana Nutt. (imbricaria × velutina)			+			
Quercus macrocarpa Michx.	+		+	+		+
Quercus macrocarpa f. olivaeformis (Michx. f.) Trel.			+	+		
Quercus Muehlenbergii Engelm.			+	+		+
Quercus Muehlenbergii f. Alexanderi (Britt.) Trel.						+
Quercus palustris Muenchh.			–	+	+	+
Quercus × Porteri Trel. (rubra × velutina)				+		
Quercus prinoides Willd.		+	+	+	+	+
Quercus prinoides var. rufescens Rehd.				+		
Quercus Prinus L.	+	+	+	+	+	+
Quercus × Rehderi Trel. (ilicifolia × velutina)				+	+	
Quercus × Robbinsii Trel. (coccinea × ilicifolia)				+	+	
Quercus Robur L.	•	•		•	•	
Quercus rubra L.	+	+	+	+	+	+
Quercus rubra var. borealis (Michx. f.) Farw.	+	+	+	+		
Quercus × Saulii Schneid. (alba × Prinus)			–	+	+	
Quercus stellata Wang.				+	+	+
Quercus stellata var. Margaretta (Ashe) Sarg.				+		
Quercus × stelloides E. J. Palmer (stellata × prinoides)				+	+	
Quercus velutina Lam.	+	+	+	+	+	+
Quercus velutina f. dilaniata Trel.	+	+	+	+	+	+
Quercus velutina f. macrophylla (Dippel) Trel.	+	+	+	+	+	
Quercus velutina f. pagodaeformis Trel.				+	+	
ULMACEAE						
Celtis occidentalis L.				+		+
Celtis occidentalis var. canina (Raf.) Sarg.			+			
Celtis occidentalis var. pumila (Pursh) Gray		+	+	+	+	+
Ulmus americana L.	+	+	+	+	+	+
Ulmus americana f. alba (Ait.) Fern.	+	+	+	+	+	+
Ulmus americana f. intercedens Fern.	+	+		+		+
Ulmus americana f. laevior Fern.	+	+	+	+	+	+
Ulmus americana f. pendula (Ait.) Fern.	+	+	+	+	+	+
Ulmus glabra Huds.				•	•	•
Ulmus procera Salisb.	•		•	•		
Ulmus rubra Muhl.	+	+	+	+	+	+
Ulmus Thomasi Sarg.			+	+		
MORACEAE						
Broussonatia papyrifera (L.) Vent.					•	•
Ficus Carica L.				•		
Maclura pomifera (Raf.) Schneid.				•		•
Morus alba L.	•	•	•	•	•	•
Morus rubra L.			+	+	+	+

One tree that might have been included in the above list is *Quercus falcata Michx. var. pagodaefolia Ell.* as Mr. Eugene P. Bicknell in his "Ferns and Flowering Plants of Nantucket" records a single individual growing on Nantucket. He also refers to a similar tree growing at Fairhaven, Massachusetts. It seems doubtful if this variety is really a part of our New England flora. *Castanea pumila* is included as occurring in Massachusetts, based on a single specimen from Stony Brook Reservation. That this is a native to Massachusetts is questionable.

Saururus cernuus, the only herbaceous species in this list, is a southern species occurring in the Naugatuck and Thames Valleys of Connecticut and at Little Compton, Rhode Island.

Certain trees are included which very evidently have been planted. *Ficus Carica* is in the list but it could hardly be considered as part of the flora. Other trees like *Populus alba, Salix alba, S. fragilis* and their hybrids are so firmly established that it is hard to realize that they are not native. *Populus nigra var. italica* is an interesting example of a widely distributed tree that depends entirely on propagation from cuttings. In the highway developments in recent years *Salix pentandra* has been extensively planted.

Many hybrids have been found and probably more exist that have not been identified as such. The hybrids have been omitted from the following distributional categories as have also varieties and forms which seem to have no geographical significance. Geographically the species here considered fall into groups which have already been used and defined in previous reports but in the present list there are no specimens to represent marine or estuarine habitats.

I. GENERALLY DISTRIBUTED.—*Populus grandidentata, P. tremuloides, Salix Bebbiana, S. discolor, S. humilis, S. lucida, S. rigida, S. sericea, Myrica Gale, Betula lutea, B. papyrifera, B. papyrifera var. cordifolia, Ostrya virginiana, Corylus cornuta, Fagus grandifolia.*

Wide ranging species are usually northern. Exceptions are *Ostrya virginiana* and *Fagus grandifolia* which represent species coming into New England from the Appalachian area in the southwest.

Myrica Gale (typical) is wide spread but the *var. subglabra*

is rare, occurring only in Connecticut, Rhode Island and northern Maine. While the Canoe Birches, (*Betula papyrifera* and the *var. cordifolia*), are very generally distributed, the *var. commutata* is represented by too few specimens to point to a definite range and the *var. pensilis* has been reported only from Dacey Dam and Pembroke in Maine.

II. RATHER GENERAL EXCEPT CAPE COD AND WASHINGTON COUNTY, MAINE.—*Salix rigida, var. angustata, Betula lutea var. macrolepis, Ulmus americana.*

The distribution of *Salix rigida var. angustata* seems to be much more restricted than the species. This may be more apparent than real as this variety has not been recognized until recently. *Betula lutea var. macrolepis* seems to be absent also from Aroostook County. Herbarium material of *Ulmus americana* may not be indicative of its actual range. Many collectors have failed to include it from an area in the belief that it might have escaped from cultivation.

III. NORTHERN, WITH NUMEROUS STATIONS SOUTH OF 43°.—*Populus balsamifera, Salix pedicellaris* and *S. pedicellaris var. hypoglauca, S. gracilis* and *S. gracilis var. textoris, Alnus rugosa,* and its varieties.

Salix pedicellaris is more northern and much more local than its *var. hypoglauca.* Although *Salix gracilis* and its *var. textoris* (formerly known as *S. petiolaris*) have approximately the same range, the variety is much more frequent.

IV. NORTHERN, NOT MUCH SOUTH OF 43°.—*Populus tremuloides var. magnifica, Salix coactilis, S. lucida var. angustifolia* and *var. intonsa, S. pellita, S. pyrifolia, Alnus crispa var. mollis, Betula caerulea-grandis, Quercus rubra var. borealis.*

Salix coactilis occurs only in Maine where it is local, chiefly in the Penobscot River Valley. The *varieties angustifolia* and *intonsa* of *Salix lucida* are much more northern and restricted in their distribution than the typical form which is widely distributed in New England.

V. ALPINE.—*Salix arctophila, S. argyrocarpa, S. herbacea, S. planifolia, S. Uva-ursi, Alnus crispa, Betula borealis, B. glandulosa, B. minor.*

The exact distribution can be better understood from the following table:

Mt. Katahdin	Mt. Katahdin and White Mts.	Mt. Katahdin, White Mts. and Vermont	Mt. Katahdin and northern Vermont
Salix arctophila	*S. argyrocarpa*	*S. planifolia*	*Betula borealis*
	S. herbacea	*S. Uva-ursi*	
	Betula glandulosa	*Alnus crispa*	
	B. minor		

VI. CAPE COD, GENERAL IN MAINE SOUTH OF 45°, BUT NOT NORTHERN MAINE.—*Salix nigra, Myrica pensylvanica, Comptonia peregrina, Alnus serrulata, Betula populifolia, Carpinus caroliniana var. virginiana, Corylus americana, Castanea dentata, Quercus alba, Q. bicolor, Q. ilicifolia, Q. rubra, Q. velutina.*

Myrica pensylvanica is confined to southeastern New England and the Maine coast. *Quercus velutina* is largely in southern New England but extends into southern New Hampshire and southwestern Maine. Of more general distribution are *Salix nigra, Comptonia peregrina, Betula populifolia,* and *Quercus rubra.* Other species extend east only to the Penobscot Bay and River: *Alnus serrulata* (only 2 stations beyond the Kennebec), *Carpinus caroliniana var. virginiana, Corylus americana, Castanea dentata, Quercus alba, Q. bicolor* and *Q. ilicifolia* (with only one station on Mt. Desert).

VII. NEITHER CAPE COD NOR NORTHERN MAINE AND NOT IN WASHINGTON COUNTY, MAINE.—*Ulmus rubra, Betula lenta, Juglans cinerea, Carya ovata.*

Ulmus rubra is general in New Hampshire, Vermont, Massachusetts (except Cape Cod) and Connecticut but rare in Maine and Rhode Island. *Betula lenta* has some stations in Vermont, southern New Hampshire and southeastern Maine. *Carya ovata* and *Juglans cinerea* do not extend beyond the Kennebec River.

VIII. CHIEFLY THE THREE SOUTHERN STATES.—*Quercus prinoides, Q. coccinea, Carya ovalis, C. glabra, Alnus serrulata var. subelliptica.*

Quercus prinoides has a few stations in southern Vermont and southern New Hampshire while *Q. coccinea* with the same distribution extends to York and Cumberland Counties, Maine. *Carya ovalis* is represented by 2 Maine stations, 3 New Hampshire and one Vermont but is too poorly known for any discussion. *Carya glabra* extends into southwestern Vermont and southern New Hampshire. *Alnus serrulata var. subelliptica* is more southern than the typical form but has one station in New Hampshire and one in Vermont.

IX. CHIEFLY THE THREE SOUTHERN STATES BUT NOT IN WESTERN MASSACHUSETTS.—*Saururus cernuus, Salix humilis var. microphylla, Carya tomentosa, Quercus stellata.*

Saururus cernuus comes in from the south and west and is confined to Connecticut with the exception of one station in Rhode Island. *Salix humilis var. microphylla* (*S. tristis*) reaches southern New Hampshire and has one station in Maine on Mt. Desert. *Carya tomentosa* has one New Hampshire station but none in Maine. *Quercus stellata* is limited to extreme southern Connecticut, Rhode Island, Cape Cod and the Islands.

X. CHIEFLY THE THREE SOUTHERN STATES BUT NOT ON CAPE COD.—*Carya cordifolia, Quercus Prinus, Celtis occidentalis* and its *vars. canina* and *pumila.*

Carya cordiformis extends up into western Vermont. *Quercus Prinus* occurs in western and southern Vermont, southern New Hampshire and southeastern Maine. *Celtis occidentalis* occurs in western Vermont and the *var. pumila* in the Connecticut Valley in Vermont and New Hampshire.

XI. CHIEFLY THE THREE SOUTHERN STATES BUT NEITHER CAPE COD NOR WESTERN MASSACHUSETTS.—*Quercus palustris.*

XII. COASTAL PLAIN.—*Salix humilis var. hyporhysa, Ostrya virginiana var. lasia, Quercus prinoides var. rufescens, Quercus stellata var. Margaretta.*

The typical form of *Quercus stellata* although it also occurs on the trap ridges of the New Haven, Connecticut, area is usually considered to be a coastal plain species.

XIII. CALCICOLOUS, CHIEFLY WEST OF THE CONNECTICUT RIVER IN THE SOUTH BUT IN THE EAST MOSTLY NORTH OF 45°.—*Salix candida, S. glaucophylloides, Betula pumila, Quercus macrocarpa.*

Salix candida has one station in Essex County, Massachusetts. *S. glaucophylloides* is found only in northern Maine. *Betula pumila* grows in the limestone areas of western Connecticut and western Massachusetts and in northern Maine with one station at Orono in central Maine. *Quercus macrocarpa* occurs in western New England and central Maine.

XIV. RIVER VALLEYS, CHIEFLY OF WESTERN NEW ENGLAND.—*Salix serissima, Quercus Muehlenbergii, Ulmus Thomasi.*

XV. MISCELLANEOUS.—*Populus deltoides, P. heterophylla, Salix amygdaloides S. interior, S. interior var. exterior, Juglans nigra, Betula nigra, Morus rubra.*

In some cases native species have been so widely planted beyond their normal range that the plotting of their natural distribution is difficult. *Populus deltoides*, the Cottonwood, is a western species which reaches western New England as a native plant but has been extensively planted farther east. *Juglans nigra* is another western species which occurs as a native in western New England but is planted in the east. *Morus rubra* is native in western Connecticut, western Massachusetts and southwestern Vermont but is also planted in southern New England.

Populus heterophylla, another western species, is only represented in southwestern Connecticut. *Salix amygdaloides* is confined to western Vermont and western Massachusetts. *Salix interior* seems to be confined to the Connecticut River Valley and the Lake Champlain region, while the *var. exterior* occurs only in the Aroostock River Valley in Maine. *Betula nigra* is restricted to the Merrimac and Ipswich Rivers and their tributaries except for one station in southwestern Connecticut.—R. C. Bean, C. H. Knowlton, and A. F. Hill.

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